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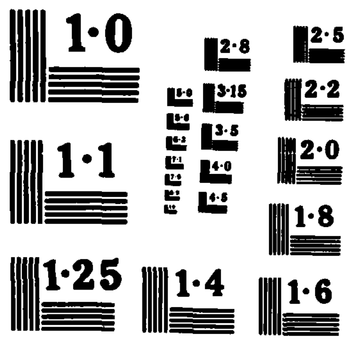

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VALIDATION OF THE ALGORITHMS FOR BASE AND DEPOT CONDEMNATION SPARES COSTS (NSN) FOR THE COMPONENT SUPPORT COST SYSTEM (D160B)

Contract No. F33600-82-C-0543

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Submitted to:

HEADQUARTERS
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EXECUTIVE SUMMARY

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system. VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The CSCS receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two standard reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on

magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort included investigations of logic, appropriateness of the algorithms and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy to the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

This report provides in one cover the validation of two algorithms, called "Base Condemnation Spares Costs (NSN)" and "Depot Condemnation Spares Costs (NSN)." The two are combined in one report because of the similarity of the subject matter and the computational processes.

Some stock numbered repairable equipment items are condemned at the base. Others are returned to the depot for processing when they are categorized as not repairable at the base level. At the depot, some of these may be condemned many months after the turn-in. The base condemnation spares cost algorithm estimates the number to be condemned based on depot experience for the current quarter. The base condemnation spares cost applies the current catalog price to both items condemned at the base and items sent from the base to the depot and later condemned there.

The depot condemnation spares cost algorithm is concerned with items originating at the depot. The algorithm assumes that each NSN issued at the depot corresponds to turn-in of an item for repair, and it estimates the condemnation spares cost in the same ways as for items sent from the base.

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This report first describes the analysis procedures, without reference to the specific algorithm addressed by this report.

Next, the Condemnation Spares Cost algorithms are defined and described in detail. This description includes identification of source data systems and files, and the calculation procedures currently implemented by the CSCS.

Finally, a critique of the algorithms is provided as required by the contract. It addresses the following topics:

- Verification of assumptions and approximations for appropriateness and accuracy.
- Validation of accuracy of source data.
- Validation of appropriateness of source data as inputs to CSCS logic.
- Investigation of accuracy and appropriateness of algorithms.
- Consideration of replacement of indirect cost methods with more direct ones.

- o Identification of algorithm impact on CSCS output reports.

For each algorithm addressed, ISI is required to affirm the process or procedure and reject any portion that cannot be affirmed. Where the algorithm or portion of the algorithm is rejected, an alternate procedure must be specified.

This report affirms the basic methodology for calculating base and depot condemnation spares costs. However, arguments are presented that the depot experience of the currently reported quarter may not be sufficiently representative for algorithm purposes. Recommendations are provided for using the most recent four quarters instead of one quarter for appropriate input data.

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1.0 INTRODUCTION

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system (all costs are computed and portrayed in "then year" dollars). VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

1.1 The Component Support Cost System

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Suppor' Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The objectives of the Component Support Cost System are:

(1) To improve the visibility of aircraft and engine component support costs and to relate those costs to the end item or weapon system.

(2) To improve the Life Cycle Costing capability for the Air Force and the Department of Defense in the acquisition of new weapon systems.

(3) To assist in the design of new weapon systems by providing cost information on existing weapon systems, thereby enhancing design tradeoff studies.

(4) To provide historical cost information at the weapon system level to improve logistic policy decisions.

(5) To identify system component reliability, effectiveness, and costs so that high support cost items may be identified and addressed.

The CSCS is described in detail in references [1], [2], and [3]. It receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two mandatory reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

The twelve reports mentioned above are of primary interest to the user community. They are identified by name in Table 1. Descriptions and samples are provided by reference [1].

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. The algorithms are identified by name in Table 2. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort includes investigations of logic, appropriateness of the algorithms, and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy of the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

1.2 Overview of the Algorithm

This report provides the verification and validation of algorithms 15 and 29 of Table 2, "Base Condemnation Spares Costs/NSN" and "Depot Condemnation Spares Costs (NSN)." The two algorithms are covered by a single report because the subject matter and the computational processes are similar.

In these algorithms, "NSN" refers to a stock numbered assembly or component. Engines are not included; they are almost never condemned (reference [31]).

In both algorithms, the condemnation cost is the estimated cost of replacing the condemned item. The number of items condemned is multiplied by the current stock list price. For base condemnations,

TABLE 1. CSCS OUTPUT REPORTS

Number*	Name
8105	Cost Factors
8104	MDS Logistics Support Costs
8106	Base Work Unit Code (WUC) Costs
8107	Total Base Work Unit Code (WUC) Costs
8111	Depot On-Equipment Work Unit Code (WUC) Costs
8108	Total Base and Depot Work Unit Code (WUC) Costs
8109	NSN-MDS-WUC Cross-Reference
8110	MDS-WUC-NSN Cross-Reference
8112	Logistic Support Cost Ranking, Selected Items
8113	Summary of Cost Elements
8114	NSN-WUC Logistics Support Costs
8115	Assembly-Subassembly WUC Costs

* CSCS output reports are assigned Report Control symbol HAF-LEY(AR)nnnn, where nnnn is the number in the table.

TABLE 2. CSCS ALGORITHM NAMES

1. Base TCTO Labor Cost
2. Base TCTO Overhead Cost
3. Base TCTO Material Cost
4. TCTO Transportation Costs
5. Base Inspection Costs
6. Base Other Support General Costs
7. Base Labor Costs
8. Base Direct Material Costs
9. Base Maintenance Overhead Costs
10. Second Destination Transportation Costs
11. Second Destination Transportation Costs (Engine)
12. Base Exchangeable Repair Costs (NSN)
13. Base Exchangeable Repair Costs (Engine)
14. Base Exchangeable Modification Costs (NSN)
15. Base Condemnation Spares Costs/NSN
16. Base Exchangeable Modification Costs (Engine)
17. Base Supply Management Overhead Costs
18. Depot TCTO Labor Costs
19. Depot TCTO Material Costs
20. Depot TCTO Other Costs
21. Depot Support General Costs
22. Depot Labor Costs
23. Depot Direct Material Costs
24. Depot Other Costs
25. Depot Exchangeable Repair Costs (NSN)
26. Depot Exchangeable Repair Costs (Engine)
27. Depot Exchangeable Modification Costs (NSN)
28. Depot Exchangeable Modification Costs (Engine)
29. Depot Condemnation Spares Costs (NSN)
30. Depot Material Management Overhead Cost

results are calculated separately for each applicable combination of base, MDS, NSN, and WUC. For depot condemnations, results are calculated separately for each combination of ALC (depot), MDS, NSN, and WUC.

"Base condemnations" count both NSNs condemned at the base and NSNs sent from the base to the depot as Not Repairable This Station (NRTS), and later condemned at the depot. The latter condemnation action may take place many months after the NRTS shipment, so the algorithm uses an estimate of the portion of NRTS items which will later be condemned.

The count of depot condemnations is driven by the number of items reported as issued from supply at the depot. The algorithm assumes that these are exchanged for items requiring repair, and that some of the latter will later be condemned. The proportion condemned is estimated in the same way as for NSNs sent from a base.

2.0 ANALYSIS PROCEDURES

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This section describes the analysis procedures, without reference to the specific algorithms addressed by this report.

The algorithm analysis process consists of six portions, described in the following sections.

2.1 Algorithm Description

The algorithms are described in references [1], [2], and [3]. These descriptions are not identical. In general they supplement, rather than contradict each other. The first two describe what the system is to achieve; the third describes the system design to do so.

None of these descriptions provides the combination of level of detail and clarity of concept required for this validation effort. The first step in the analysis methodology was the generation of such a description. The descriptions in the three reference sources just cited were made explicit. When necessary, Air Force personnel involved in implementation of the D160B subsystem were contacted for clarification.

2.2 Input Data Definitions

Closely related to the first step was the clarification of the definitions of the input data. The identification of each

input data element and of the system providing it was provided by the User's Manual (reference [1]). This identification was refined by identification of a particular file within the source system and the structure of the file as described in both the CSCS System/Subsystem Specification and in the Memoranda of Agreement. The Memoranda of Agreement have been established between the Office of VAMOSC and the Offices of Primary Responsibility (OPR) for the systems providing the input data. Any inconsistencies or voids were identified and resolved through contact with the Office of VAMOSC and/or implementing personnel.

Whenever appropriate, input data element definitions were further refined by tracing the elements back to their sources through the reference data provided. If these were inadequate, the OPRs were contacted directly for clarifications. In tracing the data back to their origins, possible sources of data contamination were considered. Information on the likelihood and significance of such contamination was collected from cognizant personnel and from published references.

2.3 Concept Validation

The two steps above established exactly what the algorithm does. The third, and most critical step, considered the validity of the procedure. It depends on the ability of the analyst to translate mathematical formulas and data processing techniques into meaningful concepts.

Some explicit techniques which were generally used in concept validation are listed below.

(a) Consider how the cost element would be calculated if there were no constraints on resources. (For example, suppose the CSCS could identify the pay grade and hours worked of each individual involved in a maintenance action.)

(b) Identify assumptions* incorporated into the Algorithm. Generally this procedure will identify the real constraints which affect the approach in (a) above.

(c) Identify approximations incorporated into the algorithm. For instance, one such approximation is the use of an average labor rate for each aircraft.

(d) Study each approximation for possible sources of error. Some examples are biases introduced by editing procedures, obsolete data, or inappropriate application. Whenever feasible, estimate the likelihood of these errors by reviews of the literature and contact with cognizant personnel.

(e) Test the algorithms under conditions of assumed extreme values for the inputs. For instance, in evaluating the algorithm for base maintenance overhead costs, assume

* Note that assumptions, approximations, and allocations are different concepts, although in some cases the boundaries between them are not sharp. ISI has recognized few assumptions in the algorithms, but many approximations and allocations.

that for a single reporting period all maintenance labor is overhead and none is direct. Also try the reverse assumption. If an assumption of an extreme input leads to an illogical result, the algorithm is flawed.

Task 4 of Section C-2, c of the contract speaks of appropriate statistical techniques to confirm or repudiate each algorithm. Statistical techniques could confirm or repudiate only statistical hypotheses as assumptions. (Use of an average does not constitute an assumption.) Accordingly, statistical techniques apply to confirmation or repudiation of an algorithm only to the extent that statistical hypotheses can be developed.

(f) As each algorithm is considered, ensure that the costs do not overlap others already accounted for. (In some cases an overlap may be necessary and desirable. Where this occurs, the overlap will be noted.)

(g) In each CSCS output report, identify the data elements incorporating the output of the algorithm, so that a final assessment of report accuracy can be made for each output report.

(h) Consider alternative sources of input data for the algorithm. Also consider more direct cost assignments then those incorporated in the algorithm.

2.4 Problem Resolution

Whenever a significant deficiency was recognized in one of the algorithms, one or more proposed solutions were developed. This was a creative analytic process for which few guidelines could be proposed in advance. Certainly it depended on familiarity with the various existing Air Force data reporting and processing systems. Proposed solutions were discussed with personnel of the Office of VAMOSC, and revised as appropriate. Recommended solutions were expressed in the form of contributions to a draft Data Automation Requirement (DAR) when these would be applicable.

2.5 Documentation

The documentation of the analysis of each algorithm was a crucial part of the effort. Emphasis was placed on making it thorough, clear, and unambiguous. In the documentation, every assertion was substantiated. This was done by reference to source documentation, by explicitly expressed application of the experience and judgment of the contractor, or by citation of information provided by cognizant Air Force personnel. In the last case, the information was supported by documentation identifying the source, the date, and the information provided.

3.0 ALGORITHM ANALYSIS

The previous section described the general analysis procedures applied to all algorithms. This section presents the results of applying those procedures to the algorithms for Base Condemnation Spares Costs (NSN) and Depot Condemnation Spares Costs (NSN).

Section 3.1 provides a detailed description of the algorithms and of the input data they use. Section 3.2 provides a critique, structured to correspond to the contractual requirements. Section 4.0 makes recommendations for solutions of problems.

3.1 Algorithm Description

In the following description COBOL-type data names are used to express the algorithm outputs and their components. The available source documentation does not provide the actual data names used by the CSCS programs. They are presumably different from those used in this report.

This description provides formulas for calculations that are derived in part from the Users Manual. Other aspects of the calculation procedures reflect our understanding of explanations provided orally by Mr. Norm Prince (LMSC/LSV). At the time this report was written, he indicated that procedures were being revised. Documentation suitable for this analysis was not available.

The calculation formulas are stated in Section 3.1.1. The input data elements and their sources are provided in Section 3.1.2. The calculation is described verbally in Section 3.1.3. Unless otherwise noted, the descriptions are based on references [1], [2], and [3], and on direct discussion with personnel of the Office of

VAMOSC. In case of any discrepancies, information provided by knowledgeable personnel was accepted as most current, hence most definitive.

3.1.1 Calculations

For purposes of this analysis, it is convenient to express the calculations performed by the two algorithms by three formulas:

$$(1) \quad \text{CONDM-PORTN} = \frac{\text{CONDM-DEPOT} + \text{CONDM-CONTR}}{\text{SVCBL-DEPOT} + \text{CONDM-DEPOT} + \text{SVCBL-CONTR} + \text{CONDM-CONTR}}$$

$$(2) \quad \text{BASE-CONDM-COST} = \text{UNIT-PRICE} \times (\text{NUM-BASE-CONDM} + (\text{QTY-NRTS} \times \text{CONDM-PORTN}))$$

$$(3) \quad \text{DEPOT-CONDM-COST} = \text{UNIT-PRICE} \times \text{DEPOT-EXCH-ISSUES} \times \text{CONDM-PORTN}$$

3.1.2 Inputs

Name: SVCBL-DEPOT

Definition: Number of items of the NSN reported as completed serviceable by organic depot maintenance for the quarter.

Source System/File: G004L/ALIG3C0(B6D7U0)

Name: CONDM-DEPOT

Definition: Number of items of the NSN reported as condemned by organic depot maintenance for the quarter.

Source System/File: G004L/ALIG3C0(B6D7U0)

Name: SVCBL-CONTR

Definition: Number of items of the NSN reported as serviceable by contractor for the quarter.

Source System/File: G072D/L0IYHAB

Name: CONDM-CONTR

Definition: Number of items of the NSN reported as condemned by the contractor for the quarter.

Source System/File: G072D/L0IYHAB

Name: UNIT-PRICE

Definition: Current catalog price of the NSN.

Source System/File: See Section 3.1.3

Name: NUM-BASE-CONDM

Definition: Number of items of the NSN condemned at the base for the quarter, identified separately for each applicable aircraft, WUC and base.

Source System/File: D143F/B21EA0

Name: QTY-NRTS

Definition: Number of items of the NSN returned to the depot as NRTS. Counts are accumulated separately by aircraft, WUC, and base.

Source System/File: D143F/B21EA0

Name: DEPOT-EXCH-ISSUES

Definition: Number of items of the NSN issued by depot supply for the quarter.

Source System/File: D033/A4TBA0

3.1.3 Description of Calculation Procedure

The following discussion explains the calculation procedure implicit in the calculations of Section 3.1.1 as applied to the inputs defined in Section 3.1.2. In order to understand the logic, it should be recognized that repairable items turned in from the

bases as NRTS to the depot are no longer identified with the base or the aircraft after they arrive at the depot. All depot systems record transactions only by NSN. Moreover, items may accumulate at the depot for months before being processed. When they are processed, some of them may be condemned at the depot. Those that are not condemned are repaired and/or modified. As will be discussed in Section 3.2.4, condemnation, modification, and repair essentially account for all of the depot costs associated with repairable NSNs. Reference [37] reviewed the algorithms for the costs of depot repair and modification of base exchangeable NSNs.

Formula 3.1.1(1) determines the ratio of items (by NSN) condemned to the total of serviceable and condemned items at the depot level for the quarter. Since the items on which this ratio is based may not be the actual items NRTSd to the depot in the current quarter, this ratio (called CONDM-PORTN) is an <u>estimate</u> of the fraction of turn-ins which will be condemned at the depot.

Formula (2) of Section 3.1.1 multiplies this fraction for an NSN by the number of NRTS turn-ins for a particular base, MDS, and WUC, to estimate the number of items condemned at the depot. To this is added the number condemned at the base, yielding the estimated total number condemned associated with the quarter. This number is multiplied by the current catalog price to give the material cost (BASE-CONDM-COST) associated with condemnations of exchangeable NSNs associated with the base. This cost is calculated separately for each applicable combination of NSN, base, MDS, and WUC.

It remains to explain where the unit price comes from. The CSCS maintains a cross-reference file which identifies NSNs and each of their applications as a WUC item on each MDS.* This file includes the current catalog price. The algorithm gets the unit price from this file. However, more must be said about the price.

First, NSN prices are revised from time to time. Updates to all catalog data are sent to the CSCS through data system D071 monthly. These updates are merged into the cross-reference file in a process not part of this algorithm, but relevant to it.

Second, the cross-reference file is currently incomplete. If an item cannot be found in it, or if there is no price, the CSCS enters the NSN into a suspense file. During quarterly processing, the list of stock numbers in this suspense file is transmitted to the D046 ("Base Account Screening Exercise") system. This system is designed to provide, among other things, catalog management data to valid users. The D046 system responds with the desired data, which the CSCS incorporates into the cross-reference file in a process not part of this algorithm, but relevant to it.

Formula (3) of Section 3.1.1 addresses the calculation of depot exchangeable items condemnation material cost. It is conceptually similar to the procedure for base exchangeable items, but there are differences. The depot exchangeable cost is based on issue of exchangeable from depot supply to depot shops. Such issue

* The cross-reference file will be discussed at length in a separate report.

would be in exchange for an item removed from an aircraft because it was found to need repair during programed depot maintenance. The exchange at depot level is treated as is the turn-in of a NRTS item from a base; the proportion of items condemned is estimated the same as for items initiated at a base.

Depot issues are identified by NSN in system D033 (the AFLC Retail Stock Control and Distribution System). The information provided by this system to the CSCS does not identify aircraft and Work Unit Code, but it does provide a "Control Number." Through this number, the CSCS can interrogate the G004L system and identify the aircraft and WUC. This process, however, is not part of the costing algorithm. The D033 system does provide the unit cost directly to the CSCS.

3.2 Critique of Algorithms

This section addresses various facets of the two algorithms. The discussion is structured to correspond to the contractual requirements. Each aspect is either affirmed or rejected. Rejections lead to recommendations in Section 4.0.

3.2.1 Appropriateness and Accuracy of Assumptions and Approximations

Information Spectrum has identified one approximation and one assumption used in these algorithms. They are addressed separately below.

3.2.1.1 Disposition of NRTS Turn-Ins

In general, items turned in as NRTS by the bases will eventually be condemned, repaired, or modified at the depot. The number which will be condemned is not known at the time of the turn-in. Accordingly, it is appropriate to estimate the portion to be condemned by an approximation based on experience.

However, ISI feels that the use of the condemnation portion experienced in the current quarter is undesirable. Depot activities for a given NSN are commonly scheduled only when an economic quantity of the NSN is available. Thus a given NSN may not be considered at all for several quarters, and the proportion condemned could not be estimated. Section 4.0 recommends a change in procedure.

3.2.1.2 Unit Cost

The CSCS assumes that the current catalog price of an item is an appropriate measure of the replacement cost. Catalog prices are in theory updated when new purchases are made, and at such other times as the item manager thinks appropriate. The Office of VAMOSC plans to consider the accuracy of the input data systems in future efforts. At present, ISI affirms the use of catalog prices as appropriate.

3.2.2 Accuracy of Source Data and Congruence of Data Element Definitions

Information Spectrum was directed to validate accuracy of source data based on a survey of published findings, reports of

audit, etc. No direct sampling of data was to be performed. The Office of VAMOSC has indicated that direct validation of source data is planned for future efforts.

As indicated in Section 3.1.2, the input data is provided to the CSCS by data systems G004L, G072D, and D033. Also, as indicated in Section 3.1.3, systems D071 and D046 provide updates to catalog prices. No published criticism of the accuracy of any of these data systems could be found. Accordingly, ISI affirms their accuracy.

Next we address the congruence between definitions of input data elements as used by the CSCS and as provided by the input data systems.

3.2.2.1 <u>Serviceable/Condemnation Counts</u>

The counts of items serviceable and condemned by the depot and by the contractor are defined in Attachment A of reference [3]. These definitions are straightforward and correspond to their application by the CSCS.

3.2.2.2 <u>NRTS Turn-Ins and Base Condemnations</u>

Items condemned at bases or turned in as NRTS are routinely reported via the AFRAMS (Air Force Recoverable Assembly Management System) Daily Change Report described in Attachment A-2 of reference [25]. These reports are accumulated to yield the turn-in and condemnation counts. ISI affirms the congruence of this input data definition with the CSCS interpretation.

3.2.2.3 Depot Issues

Section 4.2 of reference [50] shows that the records of issues provided by the D033 data system may include both exchangeable and non-exchangeable material. The ratio represented by formula (1) of Section 3.1.1 of this report should apply only to exchangeables. However, the numerator of formula (1) will automatically be zero for non-exchangeables, so it does not matter if issues of non-exchangeables are processed by the algorithm. With this understanding, ISI affirms the congruence of the data definition.

3.2.2.4 Unit Price

When the replacement item is exactly the same as the condemned item, the catalog price seems quite appropriate. However, it must be recognized that condemned items may be replaced by interchangeable and substitutable (I&S) items from the supply inventory. In this case, the catalog prices may be different. There is no convincing rationale for asserting that one price is more appropriate than the other.

The base condemnation spares algorithm implicitly uses the price of the turned-in item, while the depot condemnation spares algorithm uses the price of the issued replacement. This is a small inconsistency. We can see no feasible way to change the base algorithm to the cost of the replacement item. The depot algorithm might be changed to a basis of turn-ins rather than issues, for the sake of consistency. However, the advantage would be small, and ISI feels that issues are slightly preferable as a cost basis.

Provided that users are made aware of the meanings of the costs in both algorithms, the congruence of the input data definitions is affirmed.

3.2.3 Appropriateness of Source Data as Inputs

Section 3.1.2 showed that depot production data is provided by the G004L system, and contractor production data from G072D. NRTS turn-in counts are from D143F and depot issues from D033. In addition, Section 3.1.3 showed that D071 provides updates to catalog prices, while D046 responds to requests for missing catalog data. Information Spectrum has reviewed documentation describing the operation of each of these data systems. Each is designed to provide the appropriate form of information to users. ISI affirms their appropriateness.

3.2.4 Accuracy and Appropriateness of Algorithms

As explained earlier, items turned in to the depot for repair may not be processed for many months. Accordingly it is appropriate to use an estimate for the number of turned-in items condemned. ISI affirms the appropriateness of the approach.

The accuracy would be appropriate if the estimate of the proportion of items condemned were representative. As suggested earlier, the primary problem is that the current procedure depends on reports from the current quarter. If no items of the NSN were processed at the depot, then no such estimate is possible. A recommended change in the procedure is provided in Section 4. If this is implemented, we believe the accuracy of the algorithms will be satisfactory.

3.2.5 Directness of Costing

It may be noted that the condemnation costs developed by these algorithms are the material costs for replacement. The labor costs associated with determining that an item is condemned at the depot, as well as the labor costs for replacing the item, are all counted as repair costs and accounted for in the base exchangeable repair cost algorithm (reference [37]).

Having acknowledged that condemnation costs must necessarily be based on estimated, not actual, condemnation rates, the remaining factors of the algorithms are direct. Information Spectrum affirms the directness of the costing.

3.2.6 Application to CSCS Output Reports

Base condemnation spares costs impact elements of seven CSCS reports as described by Table 3. Depot condemnation spares costs impact elements of six CSCS reports as described by Table 4. The total accuracy of each report cannot be addressed until all algorithms impacting the report and its respective cost elements have been reviewed. This will occur in the final report of this effort. Evaluation of the usefulness of the reports will also be provided in the final report of this effort and after ISI conducts a survey of users.

TABLE 3

CONTRIBUTION OF BASE CONDEMNATION SPARES COST ALGORITHM TO CSCS OUTPUT REPORTS

OUTPUT REPORT/NUMBER [1]	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHM [2]
1. MDS Logistics Support Costs/8104	1. By MDS for all bases: a. WUC COMPONENT COSTS, BASE b. TOTAL MDS COSTS c. COST PER A/C d. COST PER F/H e. COST PER LANDING f. COST PER SORTIE g. By two digit WUC, QTR COST
2. Base Work Unit Code (WUC) Costs/8106	2. By MDS and base: a. TOTAL BASE COSTS, COMPONENT b. WUC COSTS (1) CONDMN SPARES (2) TOTAL WUC
3. Total Base Work Unit Code (WUC) Costs/8107	3. By MDS for all bases: a. TOTAL BASE COSTS, COMPONENT b. WUC COSTS (1) CONDMN SPARES (2) TOTAL WUC
4. Total Base and Depot Work Unit Code (WUC) Costs/8108	4. By MDS for all bases: a. TOTAL COSTS, COMPONENT b. WUC (1) BASE CONDMN SPARE COST (2) BASE & DEPOT WUC TOTAL
5. Summary of Cost Elements/8113	5. By MDS for all bases: SUSTAINING INVESTMENT, REPLENISHMENT SPARES CONDEMNATION COST, BASE
6. NSN-WUC Logistics Support Cost/8114	6. By NSN for all bases: a. By MDS (1) WUC BASE COSTS: CONDEMN SPARES (2) TOTAL W/I MDS b. TOTAL NSN

[1] CSCS output reports are assigned Report Control Symbol HAF-LEY (AR) nnnn, where nnnn is the number in the table.

[2] Capital letters indicate the title printed on the table.

TABLE 3

(Continued)

OUTPUT REPORT/NUMBER	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHM
7. Assembly-Subassembly WUC Costs/8115	7. By MDS and WUC for all bases: a. BASE CONDEMNED SPARES COST b. BASE & DEPOT WUC TOTAL

TABLE 4

CONTRIBUTION OF DEPOT CONDEMNATION SPARES COST ALGORITHM TO CSCS OUTPUT REPORTS

OUTPUT REPORT/NUMBER [1]	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHM [2]
1. MDS Logistics Support Costs/8104	1. By MDS for all bases: a. WUC COMPONENT COSTS, DEPOT b. TOTAL MDS COSTS c. COST PER A/C d. COST PER F/H e. COST PER LANDING f. COST PER SORTIE g. By two digit WUC, QTR COST
2. Total Base and Depot Work Unit Code (WUC) Costs/8108	2. By MDS for all bases: a. TOTAL COSTS, COMPONENT b. WUC (1) DEPOT CONDMN SPARE COST (2) BASE & DEPOT WUC TOTAL
3. Depot On-Equipment Work Unit Code (WUC) Costs/8111	3. By MDS and ALC: a. DEPOT TOTAL COSTS, COMPONENT b. WUC (1) CONDMN (2) WUC TOTAL COST
4. Summary of Cost Elements/8113	4. By MDS for all bases: SUSTAINING INVESTMENT REPLENISHMENT SPARES CONDEMNATION COST, DEPOT
5. NSN-WUC Logistics Support Cost/8114	5. By NSN for all bases: a. By MDS (1) WUC DEPOT COSTS: CONDEMN SPARES (2) TOTAL W/I MDS b. TOTAL NSN
6. Assembly-Subassembly WUC Costs/8115	6. By MDS and WUC for all bases: a. DEPOT CONDEMNED SPARES COST b. BASE & DEPOT WUC TOTAL

[1] CSCS output reports are assigned Report Control Symbol HAF-LEY (AR) nnnn, where nnnn is the number in the table.

[2] Capital letters indicate the title printed on the table.

4.0 RECOMMENDATIONS

Section 3 has presented our assessment that the algorithms for base and depot condemnation spares costs are fundamentally sound. One weakness was identified in Section 3.2.1: the algorithms both depend on having an estimate of condemnation rate for each applicable NSN for the current quarter. One quarter may be too short a period to develop a representative rate. We recommend that the most recent four quarters be used. Note that use of four quarters would avoid any seasonal biases. Even in this case, it may turn out that no items of an NSN were processed in the past four quarters. If this occurs, then the previous estimated condemnation rate should be retained.

In the Air Force Logistics Command, changes to automated data systems are initiated through preparation of AFLC Form 238, "Data Automation Requirements," (DAR). This form contains a number of administrative entries, together with three items of substantive content: "Requirements," "Impact Statement," and "Justification Benefits/Cost Savings." Attachment 1 provides a draft of these sections appropriate to the recommendation.

4.0a Office of VAMOSC (OOV) Comments

Concur. The use of data for the current quarter only for computation of percent depot condemnations may cause some distortion of the data when activity is low for a particular NSN. By using accumulated counts for the most recent four quarters to compute percent depot condemnations, we should portray more accurately

the costs for replacing items condemned at the depot. A DAR requesting this change will be prepared and submitted by 31 May 84.

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MEMORANDA OF AGREEMENT FOR SYSTEM INTERFACES

Ref. No.	Memorandum No.	Date
[6.1]	D002A/M024B/D160B-A	9 Jun 1980
[6.2]	D002A/M024B/D160B-B	9 Jun 1980
[6.3]	D024A/D160B-A	30 Jun 1980
[6.4]	D033./ARC/D160B	14 Jun 1980
[6.5]	D042A/DNB/D160B	4 Nov 1983
[6.6]	D046/M024/D160B	9 Apr 1981
[6.7]	D046/D160B	23 Jun 1982
[6.8]	D056A/BDN/D160B-A	23 Jan 1981
[6.9]	D056A/D160B-C	13 Oct 1981
[6.10]	D056A/D160B-D	29 Jan 1981
[6.11]	D056A F005	25 Apr 1979
[6.12]	D056B/BDN/D160B-A	22 Dec 1980
[6.13]	D056C/D160B-A	4 Mar 1981
[6.14]	D071/D160B	17 Jun 1982
[6.15]	D143B/D002A 9159	3 Aug 1979
[6.16]	D143F/ARC/D160B-A	5 Feb 1981
[6.17]	D160/D160B	11 Jun 1982
[6.18]	G004L/M024B/D160B-A	30 May 1980
[6.19]	G004L/M024B/D160B-B	30 May 1980
[6.20]	G004L/M024B/D160B-C	5 Nov 1981
[6.21]	G019F/D160B	8 Sep 1982
[6.22]	G033B/D160B	12 Jul 1982
[6.23]	G072D/BDN/D160B-A	19 Apr 1982

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES (Continued)

Ref. No.	Memorandum No.	Date
[6.24]	H036B/RC/D160B-A	10 Feb 1981
[6.25]	H069R/M024B/D160B-B	19 Jan 1981
[6.26]	0013/BDN/D160B	22 Jul 1982

Attachment 1: Proposed DAR Entries Supporting Modifications to VAMOSC II Component Support Cost Subsystem (CSCS) to Improve Calculation of Base and Depot Condemnation Spares Costs for NSNs

Requirement

In the algorithms identified by Sections 5-17.d and 5-31.c of AFR 400-31, Volume IV (6 August 1982), it is requested that all input data be the sum of the values for the most recent four quarters. In these calculations, if a denominator is zero, the output quantity from the previous quarterly processing cycle should be re-used.

Impact Statement

Failure to implement may contribute to erratic, non-representative fluctuations in estimates of exchangeable repair and modification costs.

Justification Benefits/Cost Savings

Evaluation of the inaccuracy of the current procedure would require investigation and analysis. Such an investigation does not appear appropriate since in any event the required programming effort should be small.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study is the eleventh of a set of reports documenting the findings of a study conducted by Information Spectrum, Inc (ISI) for the Office of VAMOSC, Air Force Logistics Command. This study constitutes an assessment of the algorithms for Base and Depot Condemnation Spares Costs (National Stock Number) within the Component Support Cost System (CSCS) subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Cost system. CSCS deals with subsystems and components for aircraft

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20. This report combines the two algorithms because of the similarity of the subject matter and the computational process. Some stock numbered repairable equipment items are condemned at the base. Others are returned to the depot where they may be condemned many months after the turn-in. The base condemnation spares cost algorithm estimates the number to be condemned based on depot experience for the current quarter. The depot condemnation spares costs algorithm is concerned with items originating at the depot. The algorithm assumes that each stock number issued at the depot corresponds to turn-in of an item for repair, and it estimates the condemnation spares cost (current catalog price) in the same ways as for items sent from the base.

The volume presents ISIs conclusion and recommendations, and the comments of the Office of VAMOSC.

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